How theories of practice can inform transition to a decarbonised transport system

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Abstract

In this article, I explore the potential of theories of practice to inform the socio-technical transition required to adequately decarbonise the UK transport system. To do so I push existing applications of practice theories by articulating a 'systems of practice' approach, which articulates theories of practice with socio-technical systems approaches. After sketching out a theory of practice, I explore the potential of a practice theory approach to illuminate systemic change in transport. I do this by confronting two key criticisms of practice theories; first of their difficulty in accounting for change; second in their limited ability to move beyond a micro-level focus on doing. The counter I offer to these criticisms leads directly into recognising how theories of practice can articulate with socio-technical systems approaches. From this basis, I go on to consider the implications of a practice theory approach for informing interventions to effect a system transition towards decarbonised transport.

Keywords

Practices; socio-technical systems; transition; transport; cycling; driving

1. Introduction

Transport is a deeply complex and profoundly embedded socio-technical system. A reduction in its dependence on fossil fuels of the scale which appears to be necessary requires a fundamental transition. The question which of course follows is how that transition can be effected.

My initial contention in respect of this question is that systemic transitions only happen if enough people do enough things differently enough. On one hand this contention is very obvious. But on the other hand, it sounds fantastically reductionist; individualistic and sociologically naïve. As Frank Geels and others who have analysed the multi-scalar, heterogeneous complexity of socio-technical systems have shown, transitions occur through the dynamism of relations between technologies, infrastructures, markets, norms, regulations and other constituents of systems across spatial and temporal scales (Elzen and Wieczorek, 2005; Geels and Schot, 2010; Rip and Kemp, 1998). Decades of work analysing past transitions and confronting the challenges of future transitions have shown that change cannot be reduced to individual choices about behaviour. Rather, we need to pay attention to processes within the complex systems at stake, including how new properties of systems emerge from complex relations between entities, and positive feedback effects whereby processes of change become self-extending.

How then do we accommodate and work with the evident truth of that initial contention within understandings of socio-technical transition? Established policy approaches to changing what people do continue to frame human action primarily as a matter of individual choices, through which behaviours are an outcome of attitudes (Shove, 2010). The profoundly limited successes of the suite of interventions which follow from this framing – such as education, persuasion and economic incentives – suggest we need to find an alternative approach to human action to inform interventions.

For theories of practice, what people do is never reducible to attitudes or choices, or indeed to anything simply individual. Rather, doing something is always a *performance* of a *practice*. It is this understanding which gives the link between changes in what people do and the rest of any socio-technical system. Attempting to make this link is to engage with an existing field of tension between two prominent approaches; theories of practice on the one hand, and socio-technical systems approaches on the other. Each has been applied to conceptualising the challenges of societal response to issues of environmental sustainability and each of which seek both to problematise expectations of a technological solution somehow independent of the social, and each of which contest individualistic explanations of human action. However, socio-technical systems approaches, particularly as articulated through the Multi-Level Perspective (Geels, 2002; 2005), conceive of systems as operating at a range of distinct scales. Meanwhile theories of practice can be understood as focusing always upon the local and immediate, in the details of doing (Geels, 2010). However, for the position I articulate in this article, practices (and therefore what people do) are partly constituted by the socio-technical systems of which they are a part; and those socio-technical systems are constituted and sustained by the continued performance of the practices which comprise them. Consequently, changes in socio-technical systems only happen if the practices which embed those systems in the routines and rhythms of life change; and if those practices change, then so will the socio-technical system. Enough people doing enough things differently enough for transition to happen is not, then, a matter of atomised individuals choosing to do differently. Nor is it accounted for by systemic shifts which occur independently from changes in what people do. Any socio-technical transition has to be a transition in *practices*.

In what follows, I first sketch out a theory of practice against the background of the diverse intellectual history of practice theories. From there I explore how a practice theory approach can illuminate systemic change in transport. For this I need to confront two key criticisms which practice approaches have gathered: first, that they are better for accounting for stability than they are for understanding change; second, that their utility for understanding socio-technical processes is limited to comprehending the detail of local doings. I attend to both of these criticisms by exploring how far a practice approach can be articulated with established conceptualisations of systems of personal mobility (Geels, 2004; Urry, 2004), and what difference a practice approach makes. Finally, I consider what implications follow from a practice theoretical approach for governing for a transition towards a decarbonised transport system.

Through this, I focus primarily on the issue of modal shift, particularly through consideration of the dynamic relations between driving and cycling. Thinking about possible shifts from driving to cycling can reveal only a small part of possible pathways to decarbonisation, but looking at the relations between these two mobility practices provides a useful lens for exploring the broader utility of practice theories.

2. Introducing theories of practice

Theories of practice offer distinctive and challenging ways of understanding human action, and its relation with social order and change. Their distinctiveness and potential become easiest to grasp following articulation of what a practice is. Empirically, any recognisable activity can be considered a practice, with relevant examples for the present discussion including walking, cycling, driving or bus riding. In his account of an 'ideal type' of practice theory, Reckwitz identifies a practice as:

> a routinized type of behaviour which consists of several elements, interconnected to one other: forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge.
>
> (2002: 249)

It is possible to read this as consistent with understanding of practice, as in common usage, simply as referring to what people do, the habits of an individual. This would be to miss the radical implications of the concept. For Schatzki (1996: 13),

"both social order and individuality ... result from practices". This bold statement makes plain the intellectual ambition of theories of practice. Practices are not simply points of passage between human subjects and social structure. Instead, practices are at centre stage, the location of the social (Reckwitz, 2002), with implications for understanding agency and social order, stability and change.

This distinctive account of the social emerges from a diffuse and in some ways fractured tradition with intellectual roots reaching back at least as far as Wittgenstein and Heidegger. From these beginnings, theories of practice took on more recognisable form from the 1970s. Diverse theorists including Taylor (1971), Bourdieu (1977; 1990), de Certeau (1984) and Giddens (1984) developed and deployed approaches in terms of practices. While conceiving of practices in different ways, each used the concept of practices as part of closely related approaches to comprehending the relations between social structure and human action, understanding those relations as recursive, with structure and action co-constitutive or one another.

Through the routes provided by these and other thinkers, theories of practice figured in different strands of social scientific endeavour through the 1980s and 90s. Towards the close of the twentieth century they gained new impetus. The continued diversity of theories of practice in the twenty first century was recognised by Reckwitz, who provided a cogent summary and exposition of the common characteristics of prominent approaches to practices, as a basis for outlining an "ideal type of practice theory" (Reckwitz, 2002: 244). He positions theories of practice amongst other cultural theories, all of which "highlight the significance of shared or collective symbolic structures of knowledge in order to grasp both action and social order" (246). He identifies the distinctiveness of theories of practice by where they locate the social. Rather than existing in the minds of individuals, in discourse or symbolism, or in intersubjective interactions, the social is situated in, emergent from, the flow of practices.

To understand how the concept of practice can carry this much intellectual ambition, we need more explanation of 'a practice' than is immediately apparent from the definition of a practice at the top of this section. Reckwitz (2002: 250) goes on to explain that a practice exists as "a pattern which can be filled out by a multitude of single and often unique actions". A practice exists, in this sense, as an entity which has enduring existence across individual moments of activity (Shove et al., 2007). It is something that can be spoken of, it is possible to have a sense of the entities required to do the practice – the things, the bodily activities, know-how, the norms and rules that shape it, etc., that it takes to be able to accomplish the practice. As an entity, a practice is in some sense transcendent of individual incidences of its doing. However, a practice must also exist as performances, the accumulation of those incidences of doing. It is through performance that the "pattern" provided by the practice-as-entity is filled out and reproduced. Only through the cumulative moments of performance are the interdependencies between those elements which comprise the practice sustained over time.

To make more sense of these somewhat abstract statements, we can frame ways of doing travel as practices. For example, cycling and driving can each be understood as a practice. That means that cycling and driving each exist as an *entity*, as Schatzki has it, a 'nexus of doings and sayings' (1996: 89). So, we can talk of cycling and conceptualise the elements which constitute that practice – the technologies and material traces (bicycles, accessories, road signs, bike shops, etc.). Cycling and driving overlap in their social location as means of moving human bodies from one place to another. Each entails particular competences and modes of bodily comportment, and distinctive ways of engaging with the world being moved through. They have their social meanings, norms and rules. But the practices of cycling or driving exist as an entity only in and through its *performance* by practitioners – primarily through people riding a bicycle, or driving a car.

So far, this discussion of theories of practice has focused on its distinctive take on activity. However, alongside this goes a complementary, and radical, conceptualisation of human subjectivity. Theories of practice decentralise the individual, instead placing the practices which constitute individual lives at the centre of analysis. It is at this fundamental level that theories of practice offer a very different view of the relations between subjects and their actions than that which is taken as conventional in dominant approaches to understanding behaviour change in relation to climate change, not least in fields such as micro-economics or psychology, and within transport studies. From a theory of practice approach, individual human subjects, the practitioners of practices, can be identified as the 'carriers' or 'host' of the practice. Rather than meanings, purposes, understandings and know-how existing as attributes of the subject, they are "elements and qualities of a practice in which the single individual participates" (Reckwitz, 2002: 250). It is therefore practices, rather than either human individuals or technological systems, which are at the centre of analytical attention.

The effects of this reorientation of analytical gaze can be seen in applications of a practice theory approach to a range of energy and sustainability related issues. Shove has applied a distinctive formulation of practice theory to a range of practices, not least around cleanliness and comfort (Shove, 2003). For example, she explores the changing character of personal hygiene over time. The increasing energy demands of fulfilling escalating norms of bodily cleanliness, marked by the gradual but radical transition from the weekly bath to the daily shower as an outcome of the countless performances of the practices of bathing over decades. A practice approach here decentres individual choices to a narrative of the evolution of practice and with it the co-evolution of the technologies, competencies, meanings and temporalities which converge in a performance of the practice (Shove, 2003; Shove et al., in press). Practice approaches have been used to problematise and advance upon individualistic approaches to a range of other issues in relation to energy and sustainability. For example, Hargreaves (2011) deploys practice theory in analysis of an environmental behaviour change initiative, revealing the aspects of change and tracks of resistance that were present but elude a conventional understanding of human motivations and actions. Røpke (2009) articulates the value of a practice

approach for illuminating the profound complexities at stake in shifting consumption patterns towards sustainability.

These examples illustrate the main proven strengths of practice theories in relation to sustainability. They show how practice theories enable new understandings of past dynamics; and for revealing the profound embeddedness of patterns of doing, not least in relation to aspects of resource consumption which are often framed as individual choices. It is only very recently that scholars have begun to address the potential for theories of practice to make a difference to governing for future transition towards sustainability (Shove et al., in press; Shove and Walker, 2010; Spaargaren, 2011). In considering how theories of practice can inform transition to a decarbonised transport system, this article contributes to the progress of these debates.

To pursue this agenda, in the next section I address two key criticisms of theories of practice, as a means to articulating their value to approaching systemic change in transport. First, not least as a result of the emphasis on repetition and reproduction, they seem poorly suited to understanding change. The account of practice as an enduring entity reproduced through recurrent performances which it structures does not immediately appear to leave room for innovation and change. This appears to limit their usefulness, not least in relation to envisaging major socio-technical transitions. Second, their focus upon the complex integration of heterogeneous elements, and on the details of doing, make theories of practice most directly applicable to exploration and description at the level of everyday mundane goings-on. This has been reflected through the great bulk of the empirical work undertaken informed by theories of practice. This again appears to limit the utility of theories of practice for envisaging systemic transitions (Geels, 2010). By tackling these key criticisms, the next section draws out the distinctive utility of the approach for illuminating systemic change in transport.

3. How can theories of practice illuminate systemic change?

For theories of practice to illuminate systemic change in transport, we need to overcome apparent limitations of both understanding social change, and of reach across scales of space and time. The moves taken in countering these two criticisms are closely related.

If theories of practice saw performance as perfectly scripted by the pattern of practice as entity, their credibility would crumble as soon as they were confronted with empirical reality. Cycling is clearly done in very different ways, with wide variations even amongst utilitarian commuter cycling. If it is done differently in different parts of the world, with cycling being quite a different thing in Sheffield than it is in Beijing. And it changes over time: cycling in the UK was a very different practice in the 1940s than it is today, for example. Any practice varies over time, across space and between performances. The practice of cycling as entity provides the framing, the resources and pattern for a diversity of performances of cycling. The entity of cycling practice persists only through the succession of performances that it structures, but those performances are always potentially unique, as practitioners do the active work of integrating the elements of the practice into a contingently effective configuration, in the process of doing. Whilst innovations in a single moment of performance are always incremental, through the accumulation of different performances of cycling, the entity of cycling itself shifts over time and across space.

There are a range of different mechanisms through which practices change (Shove et al., in press). Here I want to pick out three key mechanisms of change in any practice. This then provides the basis for approaching the dynamics of practice at the systemic level.

3.1 How practices change

First, the elements comprising the practice can change. This is most obviously true in relation to the stuff required to accomplish a practice, not least processes of technological development. Both driving and cycling as distinct practices have relatively recent historical beginnings with the emergence of the technologies which define them. The story of the development of both cycling and driving can be told as tales of technological development. For technological changes to affect a practice, they have to be integrated into performances of that practice by a practitioner, with implications for the competencies and meanings that circulate within the practice. Elements of meaning and of competence can also be sources of dynamism as they are freshly integrated into performances of the practice. For example the rise of the cycle courier in major western cities in the later 20th century involved no radical technological breakthroughs, but the distinctive performances of cycling by couriers shifted the meanings of cycling, passing through into styles of clothing, cycles and bags used by other urban cyclists seeking to emulate a messenger aesthetic. Mostly, however, it is difficult to identify any single location of change to practice. Over any scale of historical view, the things, meaning and competencies of a practice co-evolve, with innovation in relation to one sort of element reconfiguring the relations between elements such that spaces open up for innovations elsewhere (Shove and Pantzar, 2005).

Second, the population of 'carriers' of the practice – people who perform it – can change. The above account of how elements within practices can change makes evident the central role of the practitioner. Moments of innovation in practice emphasise that for a practice approach, while human individuals can be decentralised from analysis, it is nevertheless necessary to recognise people and their unique capacities and active involvement in the dynamics of practices. Given that practices persist through their performance, the fate of a practice depends upon its success in recruiting practitioners able and willing to do the work of integration entailed in performance; and to hold on to them, preventing them from defecting (Shove and Pantzar, 2007). As we will see when we consider the systemic relations between practices, understanding the decline of cycling in Europe between the 1940 and 1970s as a process of defection from the practice, rather than changing individual preferences, offers different

understandings of processes of change in personal mobility (Shove et al 2012).

Third, the way in which one practice bundles together with others is significant for changes to both the elements of practices and processes of recruitment. Practices relate to each other at the level of how people perform them in the organisation their days – so driving or cycling of course can be nested between home and work or home and shopping, with their attendant practices. A practice can therefore change as neighbouring practices change. Here a practice approach to understanding personal mobility has clear resonances with insights from the activity-based approach to travel demand analysis (McNally, 2000). This approach draws upon Hägerstrand's (1970) time-geography to understand travel as embedded in how people have to negotiate space and time in the course of weaving together the activities which comprise their days. The approach has challenged conventional approaches to travel demand analysis and prediction based upon taking a single trip as the primary unit of analysis. A practice approach would similarly be concerned with this spatial and temporal bundling of travel as a means to accomplishing particular activities. However, by reframing both trips, and the activities enabled by them, as performances of specific practices, both are opened up to practice theory's distinctive analytical insights. Whilst activity-based analysis recognises the interdependencies between activities and the shape of someone's daily travel, a practice approach enables analysis of the co-evolution of practices of mobility with the other practices with high they are bundled in space and time. For example, the shifting character of grocery shopping is inseparable from shifting patterns of personal mobility, with out of town supermarkets co-evolving with patterns of personal car mobility, and with the broader restructuring of the temporal rhythms of daily life that are enabled by, and make necessary, the convenience of provisioning a household with a single shopping trip to one destination. In the process, the concentration of grocery retail, in space (large supermarkets) and time (eg once a week), has made it more difficult for cycling, walking and public transport to retain practitioners.

Practices also bundle together in more tightly integrated ways, forming what might be termed complexes of practices (Shove et al., in press). For example, driving can only recruit and retain practitioners so long as other co-dependent practices continue to be performed. In the early days of motoring, cars were so unreliable and competent professional mechanics so rare that practices of car maintenance were essentially part of the practice of driving (Borg, 1999; 2007). The progressive spread of driving and its changing meanings, from an adventurous pursuit of the wealthy to the dominant means of achieving utilitarian mobility, was partly dependent on the separation of most aspects of vehicle maintenance from the practice of driving, into ever more sophisticated technologies and specialised professional maintenance and repair services. The practice of driving is clearly dependent on a wide range of other practices, from those of transport planning and road building to fuel providing and maintaining. These interdependencies between practices only develop through the performance of the practices which comprise them. But as these interdependencies extend and progressively stabilise, they clearly come to condition the reproduction of constituent practices, to encourage broadening recruitment of practitioners, and to retain recruited practitioners to continued reproduction of a given practice.

Appreciating the relations *between* practices – not just interdependent but also competitive relations - is in fact essential to understanding dynamics within practices. Processes of change, whether to the elements of a practice or to the patterns of recruitment and defection of practitioners to it, are rarely entirely endogenous to the practice concerned. Rather they arise because of the shifting relative location of a practice within broader *systems of practice*. The example just given of the shifting practical constitution of driving brings to light how theories of practice have the (so far under-explored) potential to illuminate processes across what can be understood as systemic scales, whilst always keeping a grip on how those systems are constituted, reproduced and have presence only through the continued performance of mostly profoundly mundane practices. This is where we find the bridge between theories of practice and established approaches to socio-technical systems transitions. Through understanding how practices change we can so begin to see also how theories of practice enable analysis across systemic scales.

3.2 Systems of practice

The brief outline of progressively developing interdependencies between practices around driving resonates with established analyses of the system of automobility. While for some commentators there are ontological tensions between theories of practice and approaches to socio-technical transition like the Multi-Level Perspective (Geels, 2010), here I initially take a pragmatic approach to argue that processes of socio-technical transition can usefully be recast as transitions in 'systems of practice'. Below I explore this contention through the troubled relations between driving and cycling – or between the systems of automobility and of velomobility. What difference does it make to understand socio-technical systems as 'systems of practice'; and so understand systemic shifts as matters of the dynamics of practice?

Geels (2004) uses the car as an example with which to introduce the idea of socio-technical system in the context of systems innovations thinking. The vehicle is only one component in the socio-technical systems for transportation. The system extends also to road and traffic system infrastructures; fuel infrastructures from oil companies to petrol stations; car manufacture, maintenance and distribution networks. Beyond the technical it extends also to regulations and policies, market, culture, symbolic meaning and user practices (Geels, 2004: 20; 2005). Locating these elements as part of a system is not, of course, simply to place them together in a rag-bag. The point is to understand how these diverse elements inter-relate in structured and systemic ways (Shove, 1998), enabling understanding of the *processes* that lead to the emergence of a particular dominant structure of personal mobility.

Urry (2004) draws these elements and more into his exposition of the 'system of automobility', drawing out the complex interdependencies and feedback mechanisms between

technology, infrastructures, markets and meanings which converge around the hybrid entity of the car-driver. For Urry:

> "[a]utomobility can be conceptualized as a self-organizing autopoietic, nonlinear system that spreads world-wide, and includes cars, car-drivers, roads, petroleum supplies and many novel objects, technologies and signs. The system generates the preconditions for its own self-expansion." (2004: 27)

By conceptualising the progress of the car in society by placing it as a component within a complex, emergent system, Urry tracks the rise to dominance of the car as a process of systemic self-extension. A series of individually small innovations and broader causes in the development of motorised transport, as the 19th century turned to the 20th, seemed to irreversibly develop into a socio-technical lock-in to the petrol and steel car. The system becomes progressively extended and embedded in car technology, in oil companies, their activities and economic interests. More profoundly, the system extends to the restructuring of space, through the growth of suburbs independent of train lines, through the progressive giving over of space, not least within cities, to the logic of automobility. As Urry articulates, with the re-making of space around the car comes to a restructuring of temporalities, as the car enables the fragmentation and speeding up of tasks over space. Through the complex interaction of these different elements of the system, the car can be seen to create the conditions of its own necessity, the means for its progressive extension. So it is that automobility comes to exert its very decisive "'character of domination'" (Heidegger, in Sheller and Urry, 2000: 737), and to be "one of the principal socio-technical institutions through which modernity is organized" (Böhm et al., 2006: 3).

In terms of the elements of the system, it is notable how easily a description of the system of automobility, transfers to sketching the current 'system of velomobility', with which it has an uneasy and profoundly unbalanced coexistence. Around the technological artefact of the bicycle (or the hybrid entity of the bicycle-rider) crowds a range of elements, relationships and actors broadly isomorphic with that which gathers about the car (or car-driver). Largely shared with the car, velomobility has its road traffic infrastructures and institutions. It has too its processes of manufacture, distribution, maintenance and repair. It is regulated and governed, and part of global markets. Discourses and representations circulate around the bicycle as they do around the car. The system of velomobility, then, has a similar composition, a similar conceptual shape, to the system of automobility. So why is it that automobility has near relentless self-extension, while the system of velomobility struggles to persist in the interstices of the more dominant system? In seeking a transition to a decarbonised transport system, cannot we find ways to enable more sustainable systems of transport to find their own dynamics of self-extension to reduce the dominance of the private motor car?

The next step here is to recognise that in different times and spaces, the system of velomobility has had just such a character of systemic self-extension. As shown through histories of the emergence of cycling as a means of mass transit from the late nineteenth century in industrialised countries, the system of velomobility followed a steepening trajectory of growth. The bicycle's trajectory of innovation and normalisation fits neatly with established models of sociotechnical change (Geels, 2002). For a long period of iterative technological innovation, bicycle-riding was largely restricted to wealthy young males, its purposes more defined by enjoyment and risk taking than transport utility. However, the stabilisation of the bicycle as technological artefact (Bijker, 1997) underpinned the broader stabilisation of the emergent socio-technical system, with increasingly established forms of systems of provision, expertise, rules and meanings gathering about the bicycle. This provided the basis for the wider diffusion, the breakthrough, of cycling in the early twentieth century. While the exact period and absolute growth varied across northern Europe, many countries saw a similar trajectory in the growth of cycling, to a peak around the 1940s. In the UK by 1952, cycling accounted for some 23 billion km, 13% modal share (DfT, 2006). Pooley and Turnbull (2000), based on surveys and interviews in Britain, say that in the 1930s and 40s, around one fifth of men and one tenth of women cycled to work, and that in smaller settlements particularly, cycling was the single most important means of travelling to work in the 1940s. The machinic complex of the bicycle has certainly seen at least local dominance before.

By 1972 in the UK, cycling declined to 5 billion km, 1% modal share (DfT, 2006) with distance and modal share staying roughly stable since then (Cabinet Office, 2009). This radical decline of cycling, and its increasing corralling to a recreational rather than utility means of transport, was mirrored to a greater or lesser extent across northern European nations. This decline coincides, unsurprisingly, with the rise of the car as an increasingly democratic means of personal mobility, from the mid-twentieth century. This is not, of course, a tale of direct substitution. On the one hand, there was systemic symbiosis: the growth of the system of velomobility provided the basis of some of the elements of the coming system of automobility (Geels, 2005), from elements of production capacity and infrastructure to ideals and meanings of mechanised personal mobility. On the other hand cars do not simply replace bicycles but afford a different range of uses, meaning and purposes. Through the systemic relations that develop as part of the growing popularity of the car, there is more a process of systemic competition than any straightforward technological replacement.

In discussing this socio-technical shift at systems levels, the agency of the individual human is obscured. In Urry's articulation of the system of automobility, for example, the car-driver is a component within a systemic logic, the relation between the system and humans is one of 'coercion' to the increasingly self-evident necessity of car transport. Yet, as highlighted at the top of this paper, it is clear that systems can only emerge, persist and gain dominance by colonising what people do. Narratives of systems dynamics properly refocus attention from simplistic models of individual attitudes and behaviour which continue to dominate so much thinking and political action on fundamental social and structural issues. Yet there is still space to call for conceptualisations of systems transition to pay closer attention to the details of doing. Indeed, here we come to the nub of tension between theories of practices and socio-technical approaches to systems transitions. Geels (2010) identifies practice theory's focus on the details of local doing as a restriction upon its utility in illuminating the processes at stake in transitions which are inherently multi-level. But from a theories of practice

understanding, systems persist and are transformed only through the flow of practices – of action and doing – which comprise them. These practices clearly are not restricted to 'user' practices, or only the distinctive practices of identifiable innovators. More substantially, systems persist through the routinised performances of actors throughout the system, including public authorities, corporations, maintenance and service sectors, etc.

So, socio-technical systems, like those of automobility and velomobility, can usefully be recast as *systems of practice*. The concept of systems of practice aims to capture, simultaneously, how far practices are embedded in systemic relations constituted first by relations with other practices; and second also through the systemic elements – including infrastructures, technologies, rules, norms and meanings – which those practices constitute and sustain. This can be tested by revisiting the shifting relations of dominance between velomobility and automobility as processes of recruitment and defection to the practices of doing bicycle-riding or car-driving (or passengering).

When placed in accounts of historical, societal level shifts in socio-technical systems, it becomes clear how practices are intrinsically and actively *part* of those systems. Indeed, from a certain analytical angle at least, they can be seen as the motor of systemic obduracy and change. It is the successive moments of performance that embed, reproduce and iteratively reshape the practices; and with them the rest of the socio-technical system of which they are a part. As Shove and Pantzar (2005) argue in relation to Nordic walking, the processes by which practices recruit practitioners are inseparable from and co-constituted with processes of innovation in relation to technologies, knowledges and meanings. The recruitment of practitioners to the practice of driving can be figured as the central dynamic in the system's extension. It is centrally through the practice of driving that the diverse elements of the system (each of which elements are themselves the outcome of other practices more or less integrated to the same system) are brought together in moments of performance. Shifting systemic relations therefore both engender and are powered by this progressive recruitment.

However, as highlighted above, the rise of automobility cannot be separated from the decline of velomobility. The increasing domination by automobility is therefore in part a story of defection from cycling as well as of recruitment to driving (Shove et al 2012). As practices, cycling and driving compete for many of the same resources. Like all practices, they compete for finite resources of *time* for the practitioner. This becomes a more direct competition where performances of one practice might fall into the same slots of temporal routine and social purpose as another practice, as here in needing to get from one place to another. They compete for finite *space* on roads and in cities. They compete for *money* in complex ways – for example, once the major investment of a car is sat on the driveway, a practitioner of both driving and cycling is much more likely to choose to perform driving than they would if that investment was not sitting there depreciating. They compete in discursive and symbolic realms, between discourses of safety, health, responsibility, convenience and status. Of course, the rise of automobility was not primarily powered by defection from cycling, but also by successful competition with other modes of transport, along with progressive embeddedness in practices of planning and regional development and as the motor of growth of one of the largest economic and industrial complexes. Nevertheless, the decline of cycling from the middle of the twentieth century can be understood as automobility winning in these systemic level competitions, the defection from cycling a corollary of successful recruitment to driving.

By approaching a transition like that towards a decarbonised transport system as a transition in systems of practice reframes the problems and opportunities for intervention. The challenge becomes that of finding ways to engender recruitment to contemporary practices of different modes of mobility, which can operate in the current socio-technical landscape. This perspective represents a fundamental shift from the individualistic focus of dominant approaches to understanding travel behaviour. Rather than focus on changing individual minds to effect change in individual behaviour, exploring systems of practice, and so decentring the individual, opens up other avenues for research and for intervention. As explored in the next section, understanding transport as a system of practice promises to enable identification of intervention points which initiate or give momentum to positive feedback processes, by which increases in recruitment to less carbon intensive practices of mobility, and in defection from more carbon intensive practice, speed up.

4. What are the implications of a practice approach for interventions to enable transition in transport systems?

Established governing approaches to pursuing sustainability by changing what people do generally have had profoundly limited effects. For Shove (2010: 89) these approaches typically follow what she labels the ABC model, in which attitudes (A) are thought to drive behaviours (B) which individuals choose (C). In such a framing, individuals' attitudes, and therefore actions can be influenced by the established suite of behaviour change interventions, like education, persuasion and economic incentives. Within this framing, interventions to promote sustainability, including those that can be identified as moving transport in a less carbon intensive direction, are typically framed as helping individuals make better choices. Education, publicity and price signals are the primary instruments for engendering behaviour change, complemented with variable and generally low levels of intervention through targeted investment in infrastructures. Meanwhile, most faith is placed in technological change to deliver low carbon transport with minimal intervention to expectations of mobility, speed and convenience. Governing is necessarily a process of intervening in what people do. Could a reframing of interventions explicitly as attempts to influence the direction of practices and their relative success in recruiting practitioners make a real difference? The case for such a reframing is grounded in three key potentials within a practice approach.

First, a practice approach can illuminate the range of elements which comprise and converge in practices. As discussed,

practices are comprised from the relations between all manner of elements encompassing the material, the symbolic and the cognitive. This makes immediately apparent that all existing interventions for the decarbonisation of transport are interventions into practice, even though they are not conceived as such. Dominant forms of intervention – such as into infrastructure, transport technologies or pricing structures – are effective only in so far as they initiate changes in practice. Understanding them as such enables better anticipation of their effects as they resettle the diverse relations comprising those practices. Perhaps more significantly, however, recognition of the range of relevant elements broadens the suite of potential interventions to promote either recruitment or defection from a practice. For example if could illuminate the value of reshaping the meanings that are part of practices of car-driving or bicycle-riding; or cast fresh light on the role of embodied capacities, not least in relation to active transport.

Second, a practice approach draws attention to the ways in which practices bundle together in the organisation of people's days. Through understanding the practices which surround and make sense of patterns of mobility, alternative points of intervention arise, for example into the practices - of working, socialising, shopping, etc – which engender the need for particular modes of mobility. Here we again can recognise the substantial overlap between a practice approach and an activity-based approach to travel behaviour. The activity-based approach has resulted in exploration of opportunities to reshape where and when activities take place to change how, when and how far travel is undertaken. Shifting the location of activities in the temporal rhythm of the day (such as through flexible working hours), or in space (such as through home working) could certainly be framed within a practice approach. However, a practice approach goes further, primarily through having grounds to not take current patterns of activity as either given or static. By understanding the shifting interdependencies between practices over time, and the consequences of those interdependencies for the trajectories of any one practice, the contingency of what can seem like necessary practices – such as overseas holidays or long distance commuting – is revealed and opportunities for intervention may become visible. More subtly, understanding the detailed bundling of practices at the level of accomplishing everyday life – for example how cycle commuting works as an essential part of some family households' coordination of travel with one rather than two cars, so saving money and enabling exercise to be fitted into the daily routine – may provide small, specific but potentially significant opportunities for intervention.

Third, moving to a more systemic level, by understanding the systemic relations in which particular mobility practices are embedded, it should be possible to begin to identify possible points of intervention which set up positive feedback effects. Indeed, it is once practices are understood as systemically embedded that the insights flowing from recognition of the range of elements converging in a practice, and of the character of bundling and co-evolution between practices, can have real effect. Small interventions, such as might be made through offering urban cycling training one person at a time, seem inevitably to have small effects, especially when seen against the enormity of the challenge presented by decarbonising transport. However, if small interventions initiate or give momentum to positive feedback effects in desirable processes of recruitment and defection, their cumulative effects on the overall system can be substantial.

We can find evidence of such feedback effects by returning to the fortunes of velomobility. Hard evidence for the efficacy of policy interventions to promote cycling is patchy and sparse (Krizek et al., 2009; Pucher et al., 2009). However, it is increasingly accepted that initiatives characterised by piecemeal attempts to formalise the right of bicycle-riders to the edges of roads through road marking, construction of fragmentary sections of off road cycle routes, installation of secure cycle racks, and local attempts to promote cycling are unlikely to make any step change in recruitment to cycling. This is reflected in the general failure of strategies and policies to make any systematic difference in the low rates of cycling and walking at the national scale (Cabinet Office, 2009). However, at a sub-national scale, it is possible to see interventions which appear to have had systemic-level effects, engendering a local step change in the relative dominance of velomobility.

London and Groningen have very different forms of velomobility at the city scale. The Netherlands suffered a parallel decline in cycling to the UK through the 1950s-70s, though falling much less far.[1] While in the UK cycling essentially continued its decline, in the Netherlands a resurgence of cycling from 1975 continued, most notably to the 1990s, but cycling continues to grow. Today the Netherlands has the highest modal share for cycling in Europe, with a 27% share of trips, compared to the UK's 1% (Pucher and Buehler, 2008). While in the UK there are striking demographic inequalities in cycling, these are notably less evident in the Netherlands. In the UK men make 72% of all bicycle trips while in the Netherlands they make only 45%. In Netherlands as in Denmark and Germany, "cyclists comprise virtually all segments of society" (Pucher and Buehler, 2008 502).

In Groningen, almost 40% of local trips are made by bike. This reflects long term political commitment to cycling through fundamental, systemic, priorities, executed via mutually reinforcing policies of compact land-use, instruments to restrict car-use and investment in cycling infrastructure. In Groningen, as in many cities in the Netherlands, Denmark and Germany, investment of cycling infrastructure has a very different meaning to what might be expected in the UK. Policies can systematically subordinate motor vehicles in favour of cycling.[2] There is no public promotion of cycling, nor any campaigns to get cyclists to wear helmets. There is no need when a city's strategy for efficient personal transport is shaped around the bicycle and cycling is utterly normal and mundane (Pucher and Buehler, 2007, 2008).

Velomobility looks very different in London. It shared the UK's general decline to a low in the early 1990s. From there is began gradually to increase, but the introduction of the congestion charge in 2003 coincides with a period of rapid growth. Rates of cycling increased by at least 50% between 2003 and 2007 and

[1] By 62% from 1950-75 compared to the UK's drop of 80%

[2] E.g. in priorities at traffic lights to the extent of enabling cyclists to travel continuously through green lights if they maintain a typical cycling speed (20 kmh); slowing and widening the turns cars make at junctions, closing areas of the city centre to cars

continue to grow. This was, however, from a very low base so, while in some boroughs cycling is reported to account for 10% of journeys to work (London Travel Watch, 2009) over the city the share of journey stages was around 2% in 2007 (TfL, 2007). Substantial investment has also been made in cycling infrastructure, though this has to be in the form of interventions in a transport infrastructure evolved around very different transport policy priorities. Yet in London, the rate of recruitment to the practices of velomobility appears to exceed explanation through the direct effects of specific interventions such as the congestion charge or *London Cycle Network +*. This is indicative of the existence of secondary and feedback effects within the system. These may offer clues to the grounds for velomobility to take on its own character of self-organisation and self-extension.

These two brief cases begin to indicate how a focus upon processes of defection and recruitment to practices can help illuminate systemic effects and dynamics. As presented, the cases have prioritised policy interventions, but it is fundamental to the approach propagated here not to expect to find policy driving long term change in a system, as if policy stands outside that system determining its direction. Rather, policy is itself part of the system, and can only intervene on the basis of what has emerged from previous interventions (Rip, 2006). Thus, while it is possible, as above to present the dominance of cycling in Groningen as resulting from decades of coherent policy intervention, it is important to recognise how far that policy intervention has continually been made possible by pre-existing properties of the city's transport system. So, while cycling declined, it never became abnormal, as it did in the UK. Learning to cycle has remained a milestone of childhood development in the Netherlands, and institutional arrangements supporting the role of utility cycling have had continued legitimacy. On these grounds, initial policy interventions to reverse the decline of cycling were both politically and practically feasible. The changes affected by those interventions provided the ground for further interventions. In this way, the re-emergence of cycling in a city like Groningen is a distributed achievement, in which policy making and interventions are part of the processes of feedback and emergence. Meanwhile in London, the arrival of 'Boris bikes' (a public bicycle scheme) can be seen as an effect of complex political motivations on the part of the newly incumbent mayor; but at the same time a significant intervention into the participation and meanings of cycling in the city, shifting the ground for future policy interventions.[3]

At given scales and levels of integration, it is possible for interventions to have more than direct effects on cycling rates. Rather, they can spark off processes which have unpredictable downstream effects. There is growing evidence for one such process, a positive feedback effect. It is increasingly accepted that in general, cycling becomes safer the more people who do it (Jacobsen, 2003; Komanoff, 2004; Woodcock et al., 2007). Komanoff estimates a 'power law' relationship of approximately 0.6 between cyclist numbers and cyclists safety, such that if numbers of cyclists double, the number of accidents per cyclist-km should reduce by more than 30% (Komanoff, 2004: 148). More people cycling can have a bigger effect than end-of-pipe solutions to cycle safety such as promoting or legislating for cycle helmets.

A more diffuse effect comes through the diversification of practice as rates of cycling increase. There is growing evidence of niches of innovation in practice around cycling. Innovations here do not have to be technical, but also in meanings, competencies and purposes. For example, with the apparent beginnings of systemic self-extension in London, there is an emergence of cycling sub-cultures, such as around fixed gear bikes, or the emergence of 'velo-chic', attempting to follow the example of cities like Copenhagen and decidedly resist the peculiarly British alignment of the bicycle with fluorescents and lycra, through conspicuous elegance. Specialist shops import cycles from northern Europe that are decidedly foreign to the UK, such as cargo bikes or box fronted tricycles. Through the proliferation of manifestations of the practice of cycling, the possible points of contact through which new practitioners can be recruited are increased. An emergent technical innovation with the potential to reshape cycling recruitment is the electric bike. Benefitting from advances in battery technology in both electronics and car manufacturing, electrical power assisted pedal bicycles are increasingly widely available with mainstream cycle manufacturers launching models and retail of them spreading from specialist outlets. By redistributing the physical demands of cycling, electric bicycles clearly reshape the boundaries of recruitment to the practice, and with it the range of potential meanings and purposes that can be part of it. Finally, and perhaps the most fundamental feedback effect, is that of normalisation: the more that recruitment to cycling increases, the more normal it becomes to cycle, making further recruitment more likely.

5. Conclusion

More cycling can only do a small part in decarbonising transport. I have focused upon it in this paper as a means for exploring the potential of theories of practice for understanding the broader range of strategies which will need to be pursued to engender this transition. Other modal shifts can be approached through a similar frame, as they all entail increasing recruitment to a particular practice (walking, bus riding, etc) and similar systemic feedback effects to increase recruitment can be envisaged. The more politically difficult strategy of reducing 'need' for mobility can be framed in terms of recruitment and defection in some respects – for example considering how defection from practices of flying can be engendered. Overcoming the more universally mundane mobility needs – accomplishing the time and space coordination of getting oneself and perhaps others between home, work, shops, social engagements and leisure opportunities, generally according to a constrained and socially shared daily schedule presents deeply embedded challenges to changing what come to be constituted as obligatory travel needs in people's lives. While the job of analysing the complex interdependencies at stake here is deeply demanding, it is in principle possible through a practice approach, potentially opening up unforeseen opportunities for intervention. In the

[3] I am particularly indebted here to Tim Schwanen whose observations on short comings of my account of Groningen in a previous draft have prompted my articulation of the insights in this paragraph.

meantime, lessons for promoting modal shift are easier to identify. By appreciating the complex constituents within practices, the mechanisms by which they recruit and lose practitioners, and the ways in which they bundle one with another, it is possible to identify intervention points which have the potential to initiate or add momentum to positive feedback processes.

The emphasis of the argument above has been that current patterns of personal mobility are substantially constituted and reproduced by the mostly mundane and routinised practices of travellers. But they are also embedded in systems of power and interest which can meaningfully be understood to have existence on a global scale. While practice approaches have mostly so far found empirical application in relation to users and consumers and their ordinary doings, they equally have applicability to understanding the locales of action through which the rest of the systems of mobility are constituted. Practices recruit carriers in board rooms, the physical spaces of futures trading and government offices as much as they do on streets and in homes. This underpins the point that socio-technical systems are comprised of practices: all of the links, flows and processes comprising a system have to start and end in locales where those processes are initiated and made sense of through the performances of practices, the majority of which are routinised and mundane for the practitioners performing them. Practices in these locales may often be a more effective target of intervention to effect systemic change than in the practices of travellers.

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